

Bell Work

27-Nov-2017

How many valence electrons do magnesium and oxygen have?

Write out the ion for each compound($X^{-/+c}$).

What do you think their chemical formula would be if they combine?

EQ: What motivates students to “try” on standards tests, both high stakes (SAT, ACT, AZMerit, etc.) and low stakes (AIMS, AZVAB, etc.)?

Objective:

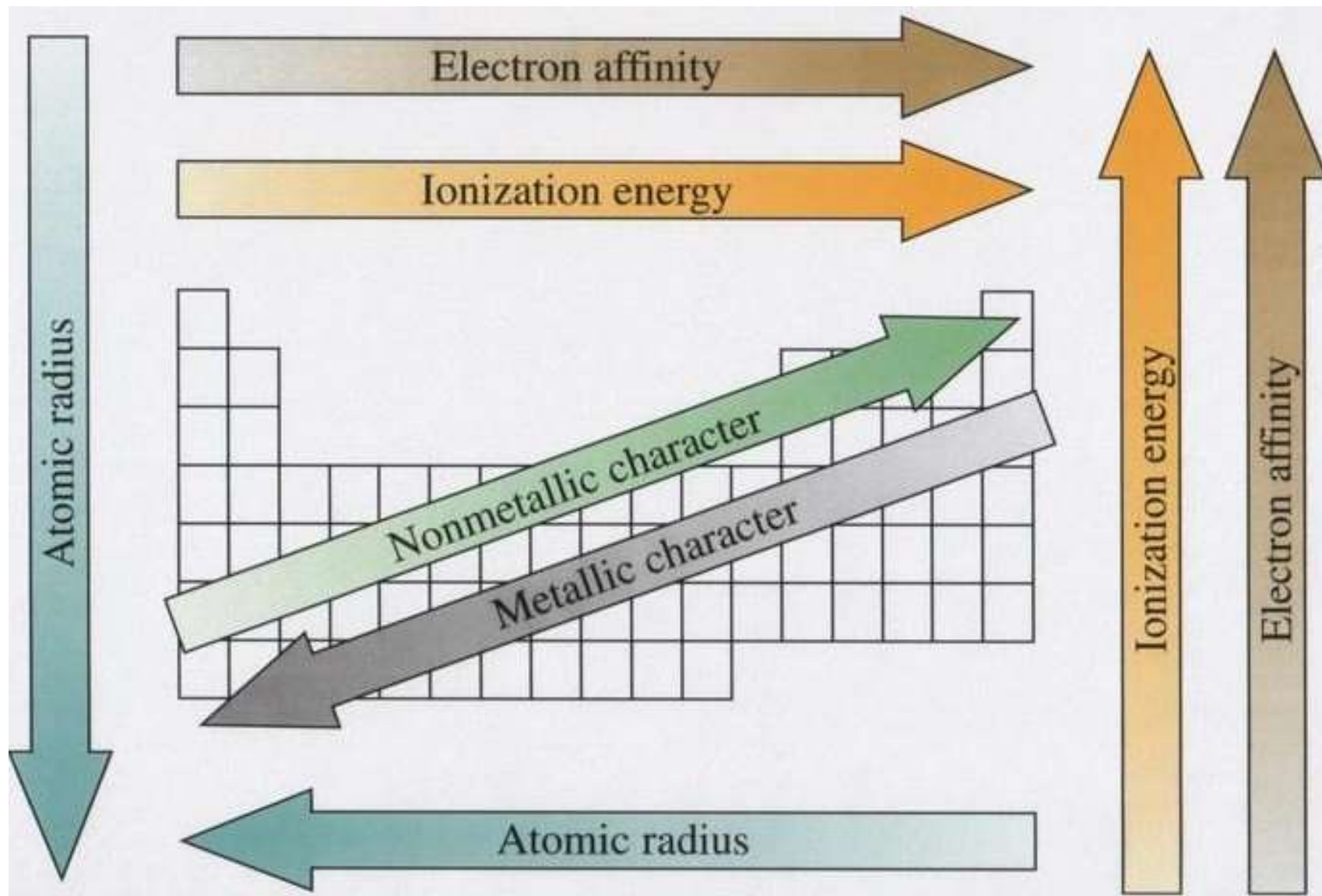
You will UNDERSTAND how to write a basic chemical formula

Ion Chips

At your lab bench go to class website and move through the notes for 27Nov17. you should understand the basics of and ionic bond. These are your note...

When finished go through and start the Ion Chip activity.

Periodic Trends



Ions

Some compounds are composed of particles called “ions”

An **ion** is an atom (or group of atoms) that has a *positive* or *negative charge*

Atoms are neutral because the number of protons equals electrons

Positive and **negative** ions are formed when **electrons** are *transferred* (lost or gained) between atoms

Ionic Compounds

Ionic compounds contain ionic bonds

Formed when e^- are given/ taken between two atoms.

e^- are exchanged between atoms so that each atom will have a full outer shell (**octet rule**).

Ionic Compounds

When e^- are given/ taken, ions are formed, & the + ions attract the - ions.

Positive ion = Cation

(Usually a metal, no change in name)

Negative ion = Anion

(Usually a nonmetal, usually ends in ide, ate, or ite)

Ionization energy/ Electronegativity Trend

Increases



The Periodic Table of the Elements

1 H Hydrogen 1.00794																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012182											5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050											13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.845	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 La Lanthanum 138.9055	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				
58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967				
90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)				

Increases

Oxidation Number Trends

+1
+2

The Periodic Table of the Elements

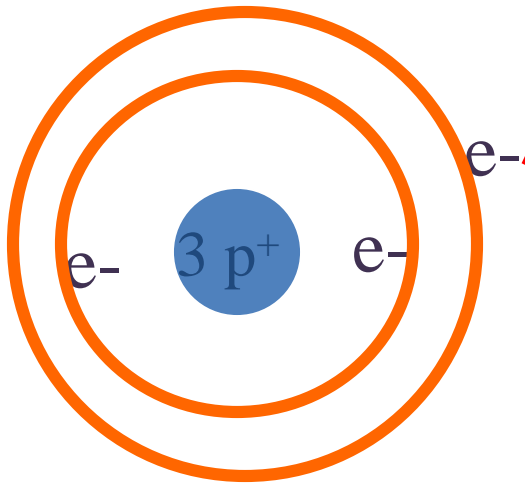
+3 **+/-** **4** **-3** **-2** **-1**

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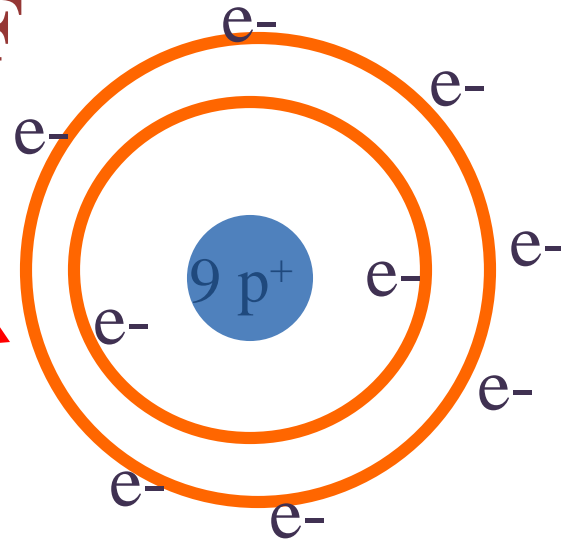
Example of how ionic bonds are formed...

Li



Wants to get rid of 1 e⁻

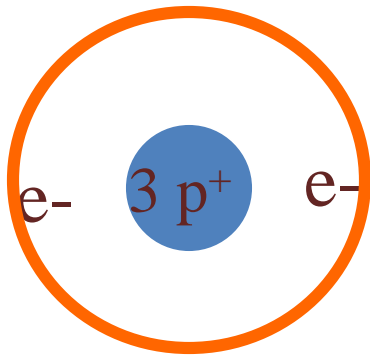
F



Wants to gain 1 e⁻

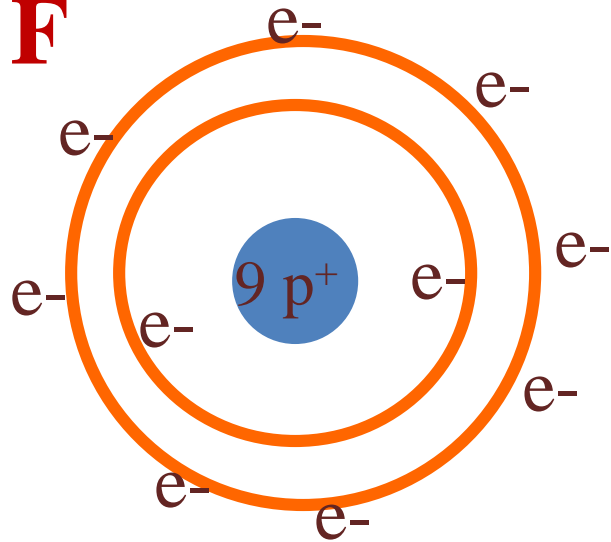
*... since there is a mutual need
to give and take one e^- ...*

Li



Gives the 1 e^- to F, to
achieve a full outer level
and...

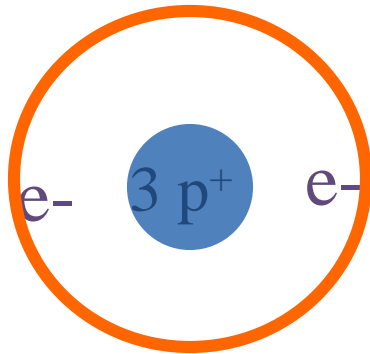
F



F gladly takes the 1
 e^- from Li to also
achieve a full outer
level.

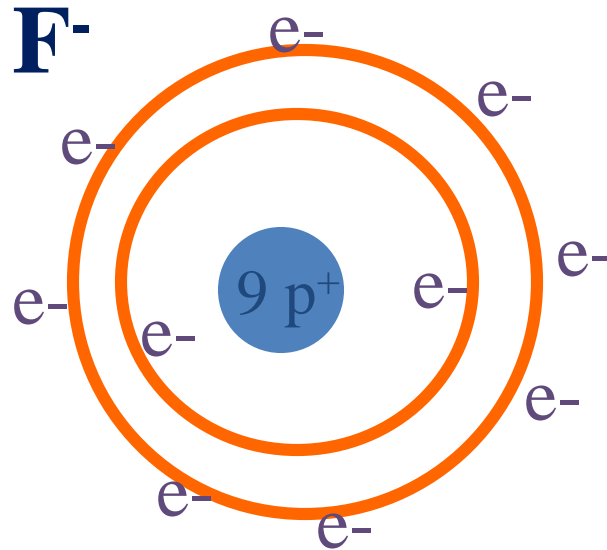
*Li and F have now become
IONS!*

Li^+



Li has 3 p+ and 2 e-

+1



F has 9 p+ and 10 e-

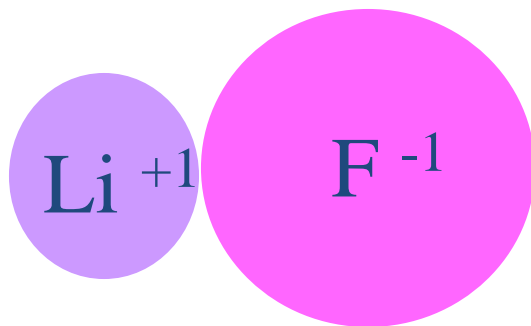
-1

Remember the rules of attraction!

Since lithium is +1 and fluorine is -1, they are attracted to each other since...

OPPOSITES ATTRACT!

Now, together, they make...



or... LiF

Ion Prediction

Correctly write the ion, showing oxidation number.

Ion	Formula	Cation or Anion
Nitride		
Chloride		
Sodium		
Oxide		
Calcium		
Phosphide		

Warm up

What charge do ions in the alkaline earth metals always have?

What charge do group 5, 6, and 7 element generally have?

Ion Chip Practice

Write the chemical formula **FIRST!**

2nd Use the ion chips to make the compound

3rd Record how many of each ion are present.

Example:

Magnesium Chloride

Aluminum Sulfate

Ion Chip Practice

Use the ion “chips” to make each of the compound on the list. Then write the correct chemical formula.

Do not loose the ions chips and return to the bag when finished.

Ex.

Show all work –
Ionic compound
name,

Home Work

7-Nov

Read through Nomenclature tutorial rules and
re work warm up in tutorial nomenclature

Bell Work
10-Nov-2014

Clear you desk except for you green sheets,
writing utensil, and calculator.

Come up with a good joke!

Bell Work

28-Nov-2017

What are the steps for writing a chemical formula (ionic)?

What types of bonds do ionic bonds form?

What are the possible endings for an anion – what do they mean?

EQ: What motivates students to “try” on standards tests, both high stakes (SAT, ACT, AZMerit, etc.) and low stakes (AIMS, AZVAB, etc.)?

Objective:

You will UNDERSTAND how to write a basic chemical formula and practice with ion chips

Ion Chip Practice

“Ion Chip Practice”

Show all 4 steps to finish #1-30.

You may use your periodic table

*Did we learn something
and can we apply it*

With a neighbor discuss...

**Which of the following is an ionic
compound and how do you know?**

Hint think electronegativity.



Bell Work

29-Nov-2017

What is meant by the term "isotope"

What is an ion?

How many valence electrons does P have?

What is its common oxidation state (charge)?

EQ: What motivates students to “try” on standards tests, both high stakes (SAT, ACT, AZMerit, etc.) and low stakes (AIMS, AZVAB, etc.)?

Objective:

You will complete ionic compounds and start notes on covalent compounds

Classes of Chemicals

- Elements
- Ionic Compounds
- Molecular Compounds (also known as **covalent** compounds)

Elements

All elements on the periodic table

All just one word: iron, sodium, neon, etc.

All neutrally charged

Mostly monatomic: Fe, Na, Ne

Some diatomic: **H₂ O₂ N₂ Cl₂ Br₂ I₂ F₂**

Gold



Ionic Compounds

Two Categories: binary ionic and ternary ionic

Binary Ionic Compounds

made of one metal - the positive ion (cation)
and one non-metal - the negative ion (anion)

Ternary Ionic Compounds

Made of one positive ion and one negative ion,
but either both of the ions or only one of the
ions is a **POLYATOMIC**

Writing formulas for binary ionic compounds

Ionic compounds are always neutral overall charge is ZERO)

Since we depend on the ionic charges to determine our formula, the number of each ion within the compound is fixed (meaning, that the number of each ion does not ever change!)

Writing formulas for binary ionic compounds

When we add up our charges as shown, we get a net charge of -1 .



Since the compound must be neutral we need another positive charge.

So, we add another sodium ion to “even out” our charge.

Now we have two sodium atoms to balance out the oxide so the final formula is:



But what's this criss-cross method they use in the book?

This method makes writing chemical formulas **sooooo** much easier!! Watch how easy it is...

Take the absolute value of the charge of the cation, and make it the subscript of the oxygen



Then do the same for the charge of the Oxygen – take the absolute value of the charge and make it the subscript for the sodium.

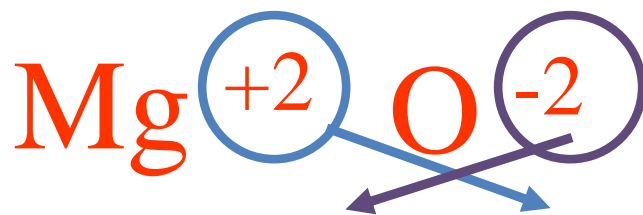
You then have...



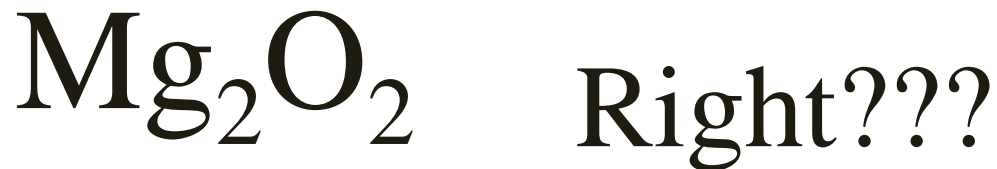
Dangers of criss-cross method

This method may be easy, but you have to be careful...

Example:



Criss-cross the charges to get...



WRONG!!

Subscripts must be reduced to the lowest multiple.

So, from our previous example...



Must be reduced to...



Practice

Make them ions then combine ☺

K and Cl

Na and S

Ca and Cl

B and I

Oxidation number

Oxidation number is the “charge” on an ion.

Not all of the ions in the representative elements follow their common oxidation states.

Ex. What would you expect carbon to be?

In carbon monoxide, CO, carbon is actually +2

Oxidation number

Some elements rarely deviate from the common charge:

F: -1

O: -2, unless a peroxide (O_2^{-2})

Alkali metals: +1

Alkaline metals: +2

Group 3 of Rep. Elements: +3 (except Tl)

Oxidation number

Generally the common oxidation states are correct but many times they are not. So we use basic algebra to determine the oxidation state:

CO: What is the charge of "C"

Remember the compound needs to be neutral, in other words the charges need to add to zero.

$$1(x) + 1(-2) = 0$$



Or "x" is +2

Oxidation number

Use basic algebra to determine the oxidation state:

Ca(NO₂)₂: What is the charge of "N"

Remember the compound needs to be neutral, in other words the charges need to add to zero.

$$1(+2) + 2(x) + 4(-2) = 0$$



Ion Chip Practice

Write the chemical formula **FIRST!**

2nd Use the ion chips to make the compound

3rd Record how many of each ion are present.

Example:

Magnesium Chloride

Aluminum Sulfate

Closure



**What type of compound am I?
(Covalent or Ionic)**

What is my name?

If Calcium weighs 40amu, Sulfur weighs 32amu, and Oxygen weighs 16amu what would I weigh?

Oxidation Number Practice



Nitrogen ?

Chlorine?

Chlorine?



Carbon?

Sulfur?

Find The Oxidization State of Each Atom



What is a polyatomic ion?

A polyatomic ion is a group of elements that travel together, and carry a charge

SO_4^{-2} = sulfate ion

CO_3^{-2} = carbonate ion

NO_2^{-1} = nitrite ion

NH_4^{+1} = ammonium ion

Using polyatomic ions in chemical formulas

- Again - Ionic compounds are always neutral so the overall charge has to add up to zero
- Example: Lithium Nitrate:



So, our chemical formula is...



What happens when you need more than one polyatomic ion?

Use parenthesis for multiple polyatomic ions

Aluminum chromate



Be careful of Hydroxides!

Calcium hydroxide



*What about...
Transition Metals???*

[illegible][illegible]

Transition Metals

Transition Metals often have more than one charge

Examples: Fe^{+2} and Fe^{+3}

This makes a difference in formula:

Iron chloride could be:

FeCl_2 or FeCl_3

*So what do we do?
(don't give up yet!)*

Since FeCl_2 and FeCl_3 are obviously not the same compound, they can't both have the same name.

We differentiate them by using a Roman Numeral to indicate the charge on the transition metal

Fe^{+2} and $\text{Cl}^{-1} \rightarrow \text{FeCl}_2 = \text{iron (II) chloride}$

Fe^{+3} and $\text{Cl}^{-1} \rightarrow \text{FeCl}_3 = \text{iron (III) chloride}$

Be sure to note that the roman numeral indicates *charge* and not *number*.

What about transition metals?

Remember – transition metals have varying charges.

Ex: Iron (Fe) exists in a +2 and a +3 state.

So, to writing formulas, the charge of a transition metal must be given to you in some form.

Most common form is a Roman numeral in parentheses after the element name.

Ex: nickel (II) nitrate: $\text{Ni}(\text{NO}_3)_2$

Here, Ni has a +2 charge, as indicated by its Roman Numeral.

Warm up

Write these formulas...

Potassium hydroxide

Silicon dioxide

Aluminum Sulfate

Barium Phosphate

Hydrogen ferrocyanide

Calcium acetate

Ionic Compounds

Two Categories: binary ionic and ternary ionic
Binary Ionic Compounds

**made of one metal positive ion (cation) and
one non-metal negative ion (anion)**

**Always two words starting with the cation
and ending with the anion**

Cation is same name as element

Anion always has a different suffix

Drop ending and add “ide”



Anion Suffixes in Binary Ionic Compounds

Anions end with ***-ide***

Oxygen ion = O^{-2} = Oxide

Sulfur ion = S^{-2} = Sulfide

Chlorine ion = Cl^{-1} = Chloride

Bromine ion = Br^{-2} = Bromide

Phosphorus ion = P^{-3} = Phosphide

Let's try some examples!

CaCl₂ Calcium Chloride

SrO Strontium Oxide

NaI Sodium Iodide

Li₂S Lithium Sulfide

Next stop: Ternary Ionic Compounds

Since the polyatomic ion already has its own name, we do not have to change anything! So... no changing suffixes, etc.

Let's practice!

Mg(NO₃)₂ *Cations are positive*

- **Remember – the first name does not change**
- **Then just add on the name of the polyatomic ion**
- **So...Mg(NO₃)₂ is named Magnesium Nitrate.**

More practice

Potassium hypochlorite KClO

Oxidation Number Review

		Number of e- in Outer Shell (Group)										III A	IV A	V A	VI A	VII A	VIII A		
Shell Number (Period)	1																		
	2																		
	3			III B	IV B	V B	VI B	VII B	VIII B		I B	II B	Share e-						
	4	+1 Charge	+2 Charge													-1 Charge	No Charge		
	5																		
	6																		
	7																		

+1 to +3 Charge

Molecular (or covalent) Compounds

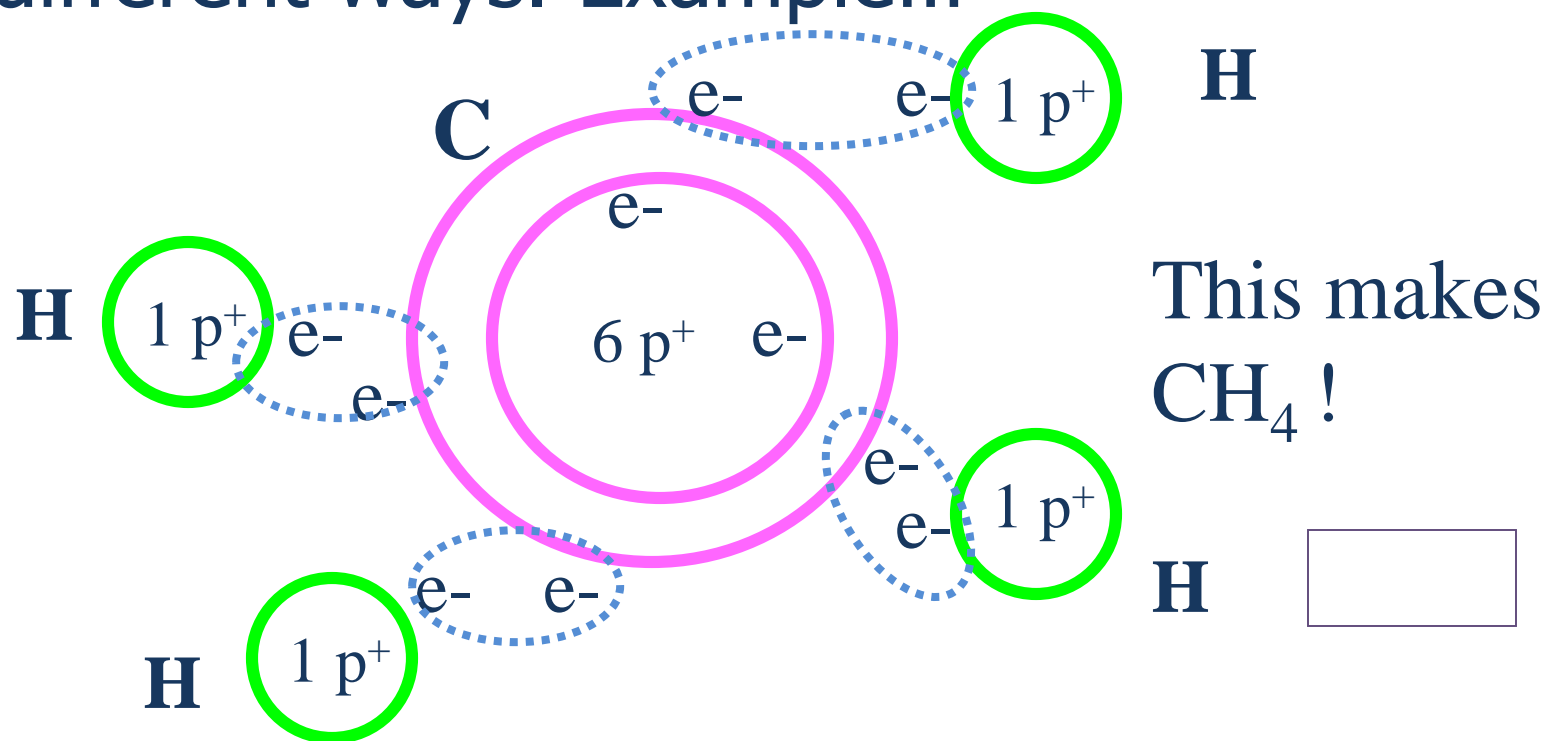
Comprised of two or more non-metals
covalently bonded (electrons are shared!)

Do not combine in set ratios like ionic
compounds.

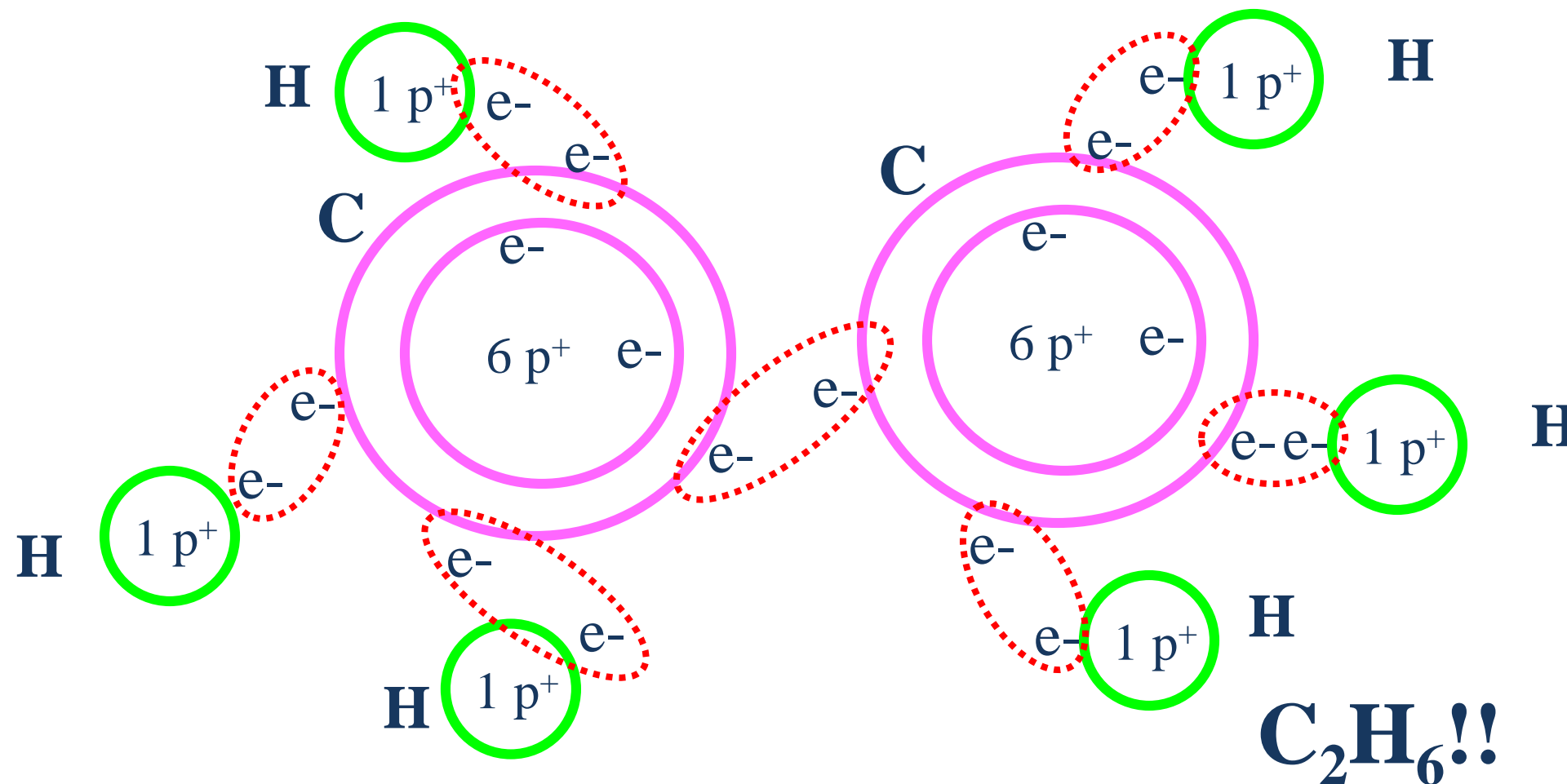
Do not conduct electricity.

Due to covalent bonds...

The same elements can combine together in different ways. Example...



But carbon and hydrogen can also combine to form other compounds, such as...



Naming Molecular/Covalent Compounds

Name as normal except that **all** compounds change the second element to an **-ide** ending

CO = carbon *oxide*

CS₂ = carbon *sulfide*

NF₃ = nitrogen *fluoride*

*Notice: the atom that is more towards the right
(**more electronegative**) on the periodic table is
listed second & ends in **-ide***

Problem

Covalent compounds can combine in multiple proportions due to the ability to share electrons and also to form double and triple bonds ... there can be more than one ratio of atoms in a compound



vs.



They can't both be carbon oxide!



vs.



They can't both be nitrogen oxide!

Solution?

Use prefixes to indicate the number of covalently bonded atoms present in the molecule

CO

vs.

CO₂

Carbon ***mon***oxide

Carbon ***di***oxide

Prefixes

- 1 Mono-
- 2 **Di-**
- 3 **Tri-**
- 4 **Tetra-**
- 5 **Penta-**
- 6 **Hexa-**
- 7 **Hepta-**
- 8 **Octa-**
- 9 **Nona-**
- 10 **Deca-**

Overall Covalent Rules

Comprised of two or more **non-metals**
covalently bonded

List the element that is ***less electronegative***
first, then list the element that is more
negative.

Name as normal except that all compounds
change the **second element** to an **-ide**
ending

Add a **prefix** to indicate # of atoms in the
compound

The second atom **ALWAYS** gets a prefix

The first atom can **ignore** MONO-

Practice



Carbon monoxide



Dinitrogen pentoxide



Phosphorus pentachloride



Sulfur trioxide



Dinitrogen monoxide

Nomenclature packet

Finish the Chemical Nomenclature packet, when you are done check your neighbors answers. We will turn this in at end of 1st half of block period.

Practice Makes Perfect

